

lesson 52 exterior angles of a polygon answer key

Lesson 52: Exterior Angles of a Polygon Answer Key

Understanding the concept of exterior angles of polygons is essential in geometry. Lesson 52 focuses on this topic, providing students with the tools to calculate and analyze exterior angles effectively. This article will delve into the theoretical underpinnings of exterior angles, their properties, and a detailed answer key for related exercises, which are crucial for mastering this concept.

What are Exterior Angles?

Exterior angles are formed when a side of a polygon is extended outward. The angle between the extended side and the adjacent side of the polygon is referred to as the exterior angle. Every polygon has an exterior angle associated with each of its sides.

Properties of Exterior Angles

1. **Sum of Exterior Angles:** One of the most fundamental properties of the exterior angles of any polygon is that the sum of the exterior angles is always 360 degrees, regardless of the number of sides. This property is true for both regular and irregular polygons.
2. **Relationship with Interior Angles:** The exterior angle at each vertex of a polygon is supplementary to the interior angle at that vertex. This means that the exterior angle plus the interior angle equals 180 degrees.
3. **Regular Polygons:** In regular polygons (where all sides and angles are equal), each exterior angle can be calculated by dividing the total sum of exterior angles (360 degrees) by the number of sides (n):

$$\text{Exterior Angle} = \frac{360}{n}$$

Calculating Exterior Angles

To calculate the exterior angles of a polygon, you can use the following steps:

1. **Identify the Number of Sides:** Determine how many sides (n) the polygon has.
2. **Use the Exterior Angle Formula:** If the polygon is regular, apply the formula for the exterior angle:

$$\text{Exterior Angle} = \frac{360}{n}$$

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3. For Irregular Polygons: If the polygon is not regular, you will need to calculate each exterior angle based on the interior angles or by extending the sides and measuring the angles formed.

Example Problems

To further understand exterior angles, let's go through a few example problems and their solutions.

Example 1: Regular Pentagon

- Problem: Calculate the exterior angle of a regular pentagon.

- Solution:

- Number of sides, $n = 5$

- Exterior Angle = $\frac{360}{5} = 72$ degrees.

Example 2: Irregular Hexagon

- Problem: An irregular hexagon has interior angles of 120° , 130° , 140° , 150° , 160° , and 170° . Calculate the exterior angles.

- Solution:

- Calculate each exterior angle:

- Exterior Angle 1 = $180^\circ - 120^\circ = 60^\circ$

- Exterior Angle 2 = $180^\circ - 130^\circ = 50^\circ$

- Exterior Angle 3 = $180^\circ - 140^\circ = 40^\circ$

- Exterior Angle 4 = $180^\circ - 150^\circ = 30^\circ$

- Exterior Angle 5 = $180^\circ - 160^\circ = 20^\circ$

- Exterior Angle 6 = $180^\circ - 170^\circ = 10^\circ$

- Sum of Exterior Angles = $60^\circ + 50^\circ + 40^\circ + 30^\circ + 20^\circ + 10^\circ = 210^\circ$.

Lesson 52 Exercises

In Lesson 52, students will encounter several exercises that reinforce the concepts of exterior angles. Below are examples of the types of problems included in the lesson, along with their answers.

Exercise Set

1. Calculate the exterior angles of the following regular polygons:

- a. Triangle (3 sides)

- b. Square (4 sides)

- c. Octagon (8 sides)

2. For the following irregular polygons, find the exterior angles given their interior angles:

- a. A quadrilateral with interior angles of 90° , 80° , 70° , and 100° .
- b. A pentagon with interior angles of 120° , 125° , 130° , 135° , and 140° .

Answer Key

1. Regular Polygons:

- a. Triangle: $\left(\frac{360}{3}\right) = 120^\circ$.
- b. Square: $\left(\frac{360}{4}\right) = 90^\circ$.
- c. Octagon: $\left(\frac{360}{8}\right) = 45^\circ$.

2. Irregular Polygons:

- a. Quadrilateral:

- Exterior Angle 1 = $180^\circ - 90^\circ = 90^\circ$
- Exterior Angle 2 = $180^\circ - 80^\circ = 100^\circ$
- Exterior Angle 3 = $180^\circ - 70^\circ = 110^\circ$
- Exterior Angle 4 = $180^\circ - 100^\circ = 80^\circ$
- Sum = $90^\circ + 100^\circ + 110^\circ + 80^\circ = 380^\circ$ (Note: This exceeds 360° ; the excess indicates a mistake in angles that must be checked).

- b. Pentagon:

- Exterior Angle 1 = $180^\circ - 120^\circ = 60^\circ$
- Exterior Angle 2 = $180^\circ - 125^\circ = 55^\circ$
- Exterior Angle 3 = $180^\circ - 130^\circ = 50^\circ$
- Exterior Angle 4 = $180^\circ - 135^\circ = 45^\circ$
- Exterior Angle 5 = $180^\circ - 140^\circ = 40^\circ$
- Sum = $60^\circ + 55^\circ + 50^\circ + 45^\circ + 40^\circ = 250^\circ$.

Conclusion

Lesson 52 on exterior angles of polygons is crucial for students as they build their foundational understanding of geometric principles. The consistent property that the sum of the exterior angles equals 360 degrees applies universally, making it a powerful tool for solving various problems related to polygons. By practicing the exercises provided in this lesson, students will enhance their problem-solving skills and gain confidence in geometry. Understanding both regular and irregular polygons will prepare them for more advanced topics in mathematics.

Frequently Asked Questions

What is the sum of the exterior angles of any polygon?

The sum of the exterior angles of any polygon is always 360 degrees.

How do you calculate an individual exterior angle of a regular polygon?

To calculate an individual exterior angle of a regular polygon, use the formula: 360 degrees divided by the number of sides (n).

What is the relationship between exterior angles and interior angles in a polygon?

Each exterior angle of a polygon is supplementary to its corresponding interior angle, meaning they add up to 180 degrees.

Can you provide an example of finding the exterior angles of a hexagon?

For a hexagon (6 sides), each exterior angle would be 360 degrees divided by 6, which equals 60 degrees.

Why are exterior angles important in geometry?

Exterior angles are important in geometry because they help in determining properties of polygons, such as symmetry and angles, and are essential in solving various geometric problems.

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